Molecular roadblocks for cellular reprogramming.

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Public Summary:
During development, diverse cellular identities are established and maintained in the growing animal. Although remarkably robust in the body, cellular identities can be changed using experimental techniques. Lineage reprogramming is an emerging field at the intersection of developmental and stem cell biology in which a adult cells are stably reprogrammed into a distinct type of cell by forced expression of specific genes . Lineage reprogramming enables the direct conversion of readily available cells from patients (such as skin cells) into disease-relevant cell types (such as brain cells and heart muscle cells) or into cells that resemble embryonic stem cells. Although remarkable progress has been made towards developing new reprogramming methods, cellular reprogramming remains difficult and needs to be improved in order increase the translational utility of reprogrammed human cells. In this review, we will discuss how transcription factors induce changes in cellular identity in the context of animal development and in cellular reprogramming.

Scientific Abstract:
During development, diverse cellular identities are established and maintained in the embryo. Although remarkably robust in vivo, cellular identities can be manipulated using experimental techniques. Lineage reprogramming is an emerging field at the intersection of developmental and stem cell biology in which a somatic cell is stably reprogrammed into a distinct cell type by forced expression of lineage-determining factors. Lineage reprogramming enables the direct conversion of readily available cells from patients (such as skin fibroblasts) into disease-relevant cell types (such as neurons and cardiomyocytes) or into induced pluripotent stem cells. Although remarkable progress has been made in developing novel reprogramming methods, the efficiency and fidelity of reprogramming need to be improved in order increase the experimental and translational utility of reprogrammed cells. Studying the mechanisms that prevent successful reprogramming should allow for improvements in reprogramming methods, which could have significant implications for regenerative medicine and the study of human disease. Furthermore, lineage reprogramming has the potential to become a powerful system for dissecting the mechanisms that underlie cell fate establishment and terminal differentiation processes. In this review, we will discuss how transcription factors interface with the genome and induce changes in cellular identity in the context of development and reprogramming.